DOCUMENT RESUME

ED 148 609 SE 023 489

TITLE	A Learning Package in Energy Conservation for Participants in the Home Building Industry. Final Report.
INSTITUTION	Houston Univ., Tex. College of Architecture.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C.
PUB DATE	Dec 77
GRANT	OE-G00-75-02108/557-BH-70004
NOTE	43p.; For related document, see SE 023 490; Contains occasional pages of marginal legibility
EDRS PRICE	MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS	*Conservation (Environment); Conservation Education; Ecology; *Educational Research; *Energy; *Energy Conservation; *Environmental Education; Natural Resources; Reports; Science Education
IDENTIFIERS	Research Reports

ABSTRACT

Presented is the final report for a project designed to develop an experimental learning package for educating participants in the home building industry in energy conservation. The project addresses deficiencies in the present knowledge status of members of the home building industry, effective marketing techniques for energy conserving homes, and attitudinal barriers towards adoption of energy conserving homes. Results indicate that the experimental learning package produced was effective in increasing participant knowledge and attitudes related to the conservation of energy in home building. (SL)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

ED148609

BEST COPY AVAILABLE

FINAL REPORT

A LEARNING PACKAGE IN ENERGY CONSERVATION FOR PARTICIPANTS IN THE HOME BUILDING INDUSTRY

PROJECT DIRECTOR:

RANJIT K. BANERJI
UNIVERSITY OF HOUSTON
COLLEGE OF ARCHITECTURE
HOUSTON, TEXAS

SPONSORED BY:

DEPARTMENT OF
HEALTH, EDUCATION
AND WELFARE /
OFFICE OF EDUCATION

GRANT NUMBER
GOO - 75 - 02108
557 - BH - 70004

DECEMBER 1977

SE 023 489

TABLE OF CONTENTS

Preface . . . . . (i)

I. Introduction 1

II. Project Objectives 2

III. Summary of Project Activities 4

Curriculum Model 5

Instructional Needs 7

Design of Instructional Delivery system and Materials 11

Pilot Testing of Instructional Materials 14

Implementing the Instructional Delivery System 16

Modeling the Evaluation Process and Formative Evaluation 22

Dissemination 24

Summative Evaluation . . . . .

External Evaluation . . . . .

All opinions, findings and conclusions expressed in this report are those of the authors and do not necessarily reflect the views of the U. S. Office of Education or the Department of Health, Education and Welfare.

PREFACE

This Final Report is submitted to the Department of Health, Education and Welfare/Office of Education in compliance with the terms and conditions of Grant No. G00-75-02108/557-BH-70004 awarded to the University of Houston. This grant was awarded for developing an experimental learning package for educating the participants in the home building industry in energy conservation.

The first budget period (September 1975 - August 1976) was devoted to designing the knowledge components of energy conservation, merchandising techniques of energy efficient homes and the instructional delivery system for effective transmission of knowledge.

The second budget period (September 1976 - June 30, 1977) was devoted to implementation of the instructional delivery system with a target group and undertaking an evaluation of the learning package by measuring attitudinal and behavioral change of the participants with regard to energy conservation in home building.

The third and final budget period (July 1, 1977 - December 31, 1977) undertook the summative evaluation of the project and dissemination of outcomes and processes.

This Final Report presents an overview of the entire project including its outcome. For convenience of the reader the summary has been presented separately from the appendices. Care has been taken to condense the voluminous materials generated over the project period without sacrificing the integrity of information presented.

Undertaking a project of this magnitude would not have been possible without a genuine interest and dedication on the part of all those individuals

who contributed to this project. They are too many to be thanked individually.

However, I wish to extend my personal graditude and that of the project staff to Dr. Eugene Welden and Mr. John Donahue of the U.S. Office of Education, whose support and encouragement made the project possible and its undertaking enjoyable.

Thanks are also due to Ms. Julie Norris, Director, Office of Research Administration at the University of Houston and her staff for giving assistance well beyond the call of duty.

December 1977

Ranjit K. Banerji

PROJECT STAFF

Ranjit K. Banerji Associate Professor of Architecture	Project Director
*Truman D. Whitfield, Ph.D. Assistant Professor of Curriculum and Instruction	Co-Director (September 1975 to July 1977)
Jerome Freiberg, Ph.D. Associate Professor of Curriculum and Instruction	Project Associate (September 1975 to June 1976)
R.A. Pendergrass Assistant Professor of Curriculum and Instruction	Project Associate (July 1976 to August 1976)
Norman Kangun, D.B.A. Professor of Marketing	Project Associate (September 1975 to June 1977)
Edit Okon Curriculum and Instruction	Graduate Assistant (September 1976 to May 1976)
Camille D. Simpson Curriculum and Instruction	Graduate Assistant (September 1976 to December 1977)
Sandra Stanley Curriculum and Instruction	Graduate Assistant (September 1975 to May 1976)
Patricia O'Sullivan Curriculum and Instruction	Graduate Assistant (September 1975 to May 1976)
Mohamad Ragab Architecture	Graduate Assistant (September 1975 to May 1976)
George Way Architecture	Graduate Assistant (September 1975 to August 1976)
Michael Dickson Architecture	Graduate Assistant (September 1976 to December 1976)
David Lipps Architecture	Graduate Assistant (January 1977 to June 1977)
Kenneth Calvert Architecture	Graduate Assistant (September 1977 to December 1977)

*Dr. Truman D. Whitfield served as a consultant on the project from August 1977 to December 1977 after he left the University of Houston to join the faculty at Murray State University, Kentucky

Mary Gilly Marketing	Graduate Assistant (September 1975 to July 1977)
Lawrence Chonko Marketing	Graduate Assistant (September 1976 to June 1977)
Charnchai Lertsachanant Architecture	Student Assistant (November 1976 to December 1977)

Secretarial Staff

Cheryl Pumilia	Senior Secretary (September 1975 to April 1976)
Phyllis Hamby	Senior Secretary (May 1976 to June 1976)
Connie Burgman	Senior Secretary (July 1976 to May 1977)
Ilann Forte	Senior Secretary (May 1977 to December 1977)
Kathy Gammage	Senior Technical Typist (October 1975 to March 1976)
Jacqueline Hatcher	Senior Technical Typist (August 1976 to October 1976)
Tomasa Ramirez	Senior Technical Typist (November 1976 to December 1977)
Particia Funches	Clerk Typist (May 1976 to August 1976)

Consultants:

Higginbotham Associates
2027 Elmen
Houston, Texas

Dr. James K. Duncan
Ohio State University
Columbus, Ohio

I. Introduction

Residential and commercial facilities account for about a fifth of the total national energy consumption in the United States. Energy conservation practices can significantly reduce energy consumption. This project assumed that by educating the major users of energy in conservation techniques along with the research and development of alternative energy sources, an enduring solution to the problem of energy shortage can be found.

One such major group of users is the home building industry. Traditionally, the prime goal of all the participants in the home building industry has been to construct and sell a dwelling unit by the quickest and least costly means possible. Energy consciousness in design and building has not been a consideration. Thus, this project undertook the development on an experimental basis of a technique for educating the above group in building energy conserving homes. The issues the project dealt with are the deficiencies in present knowledge status of the target population, effective marketing techniques for energy conserving homes and the attitudinal barriers toward adoption of these techniques.

II. Project Objectives

To achieve the goal outlined in the introductory part, the project encompasses the following objectives:

1. To increase awareness on the part of developers, financiers, builders and contractors of the national and regional energy policies. This effort has the following components:
   i) To show the economic impact vis-a-vis the impact on housing industry of increased cost of fuel
   ii) To show the energy usage pattern in different sectors of economy vis-a-vis building industry and the impact of the present pattern of usage
   iii) To increase awareness of the magnitude and complexity of the problem caused by energy shortage.
2. To provide adequate knowledge regarding energy conserving building techniques. The components of this effort are:
   i) To determine the present specific knowledge status regarding energy consumption and ways of conservation in house design on the part of participants in home building industry.
   ii) To identify the various existing techniques of energy conservation through design and develop others, if necessary.
3. To educate the participants in merchandising energy conserving homes. The essential components of this objective are:
   i) Identification of present marketing strategies and techniques adopted by the target population.
   ii) To develop effective marketing techniques for energy conserving homes.
4. To affect attitudinal and behavioral modifications in the participants with regard to energy conservation in home building. The components of this effort are:
   i) To determine the specific attitude of the target population

so that the knowledge content as well as the delivery system for transmitting the knowledge can be designed to be most effective.

ii) To identify the educational program needs which are to be met by the instructional delivery system.

iii) To design the curriculum and the instructional delivery system which would be most effective for meeting educational needs.

iv) To develop programmatic plan for implementing the instructional delivery system.

III. A Summary of Project Activities

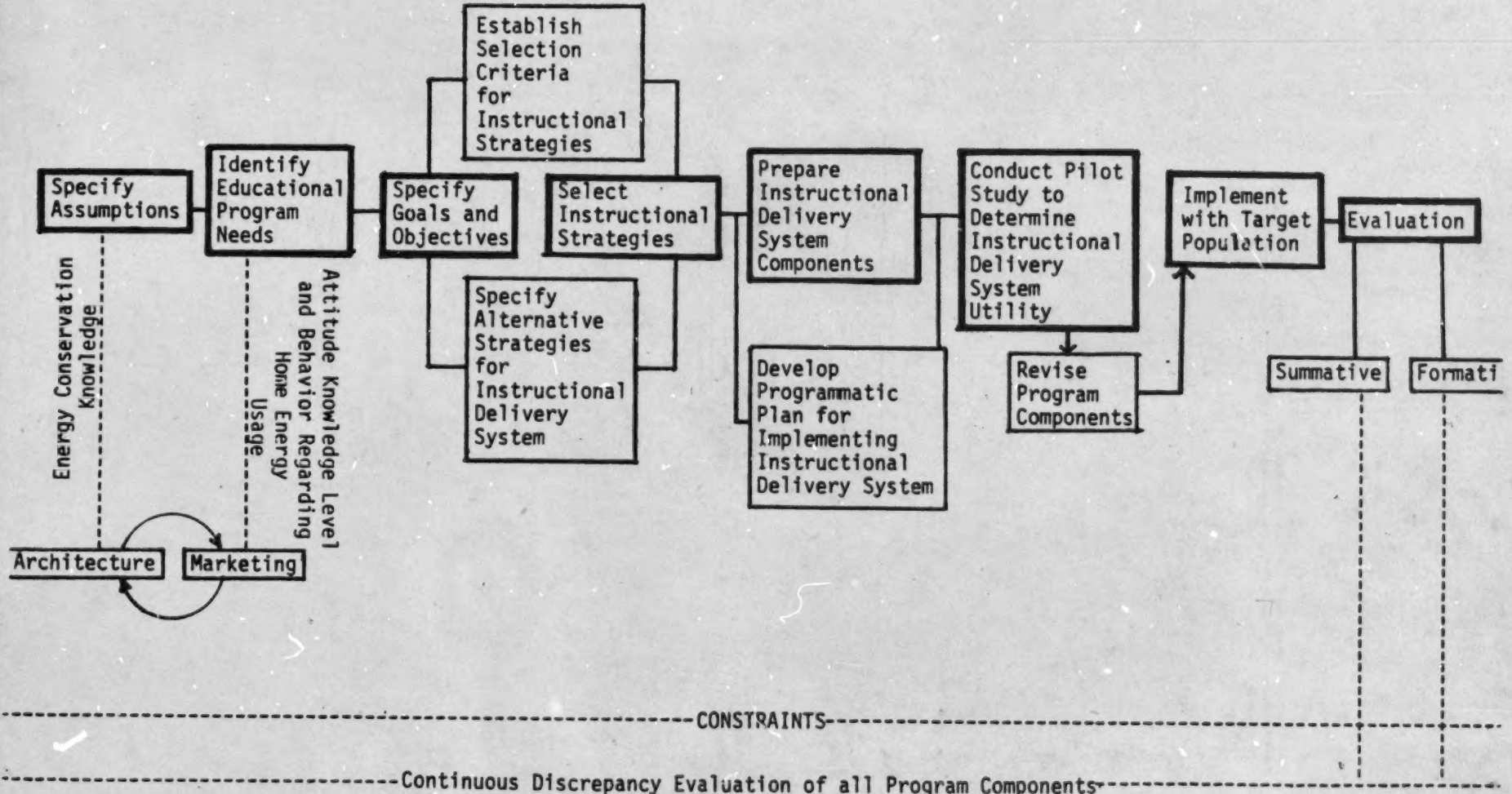
Curriculum Model

The primary goal of the project is to develop curricular materials and instructional processes, which, when used should produce knowledge, attitude, and behavioral changes in home builders, developers, contractors and financiers, relative to energy conserving design of houses. The process is based on a multi-disciplinary team approach which has brought together a staff from across three different professions--architecture, marketing and education--whose single purpose is the development of the curriculum material related to the project's goal and its delivery to the target group in the most effective manner.

When any curriculum development project is undertaken, it is necessary to develop a clear, comprehensive model that serves as the conceptual framework for the curriculum development processes. Thus, one of the first major tasks of the project was the generation of a curriculum model which could provide that conceptual framework. This model reflects as nearly as possible the various steps that we were to follow as we went about the curriculum development tasks necessary for achieving the project's goals as specified in the project's proposal. The curriculum model is reproduced on the following page. It will be referred to throughout the summary.

Another major task which had to be completed in the early stage of the project was the design of an evaluation system model for the project.* The evaluation model had to be designed at the onset of the project in that evaluation data on the project's functioning was immediately needed. The project staff decided to use a modification of the discrepancy evalu-

*See Appendix 'F'


Specify Assumptions
Identify Educational Program Needs
Specify Goals and Objectives
Establish Selection Criteria for Instructional Strategies
Select Instructional Strategies
Specify Alternative Strategies for Instructional Delivery System
Prepare Instructional Delivery System Components
Develop Programmatic Plan for Implementing Instructional Delivery System
Conduct Pilot Study to Determine Instructional Delivery System Utility
Revise Program Components
Implement with Target Population
Evaluation
Summative
Formati
Energy Conservation Knowledge
Attitude Knowledge Level and Behavior Regarding Home Energy Usage
Architecture
Marketing
CONSTRAINTS
Continuous Discrepancy Evaluation of all Program Components

ation model as discussed by E. J. Ambry.[1]

Both the curriculum model and the evaluation paradigm were completed early in the first quarter of the project. Once having the curriculum model and the evaluation paradigm the project staff then proceeded to follow the various steps as specified in the curriculum model.

If one follows the curriclumu model horizontally during the first quarter of the project, the staff was primarily concerned with the first quarter of the project, the staff was primarily concerned with the stages titled Specifying Assumptions, Identify Educational Program Needs and Specify Goals and Objectives. The project staff, through regularly scheduled meetings, verbalized and worked through the assumptions written; they were agreed to verbally. In actuality, the specification of assumptions played a vital part in arriving at the curriculum model, for inherent in the model itself are a number of inferred assumptions and these are:

1) That the target population does not possess sufficient knowledge regarding techniques for building or evaluating energy conserving homes.
2) That there exists an attitude among the target population which is not conducive to adoption of energy conserving techniques in home building.
3) That if an educational program directed to the target population in energy conservation is to suceed, economic trade offs must be made explicit.

---

[1] Ambry, E. J. "Evaluation for Environmental Education". In Taylor, P. A. and Cowley, D. M. Readings in Curriculum Evaluation. Wm. C. Brown and Company, Dubrique, Iowa, 1972, pp. 135-173.

After arriving at consensus with regard to the assumptions underlying the project, the next step taken toward achieving the proposed goals was the identification of educational programs needs. Programmatic needs identified were of two major types. First, there were those needs growing out of each academic discipline represented by the project staff. For the most part, these needs were optional needs in that they represented those conditions deemed desirable by the respective disciplines in striving to achieve the overall project goals. These academic needs were identified and the establishment of conditions necessary for meeting the needs specified during staff meetings. It was essential that these needs be identified and dealt with in order that the second type of need could be considered, e.g. substantive needs.

Instructional Needs

The substantive needs of the project were primarily from architecture and marketing. The focal point of these needs rested in the issue, "what kinds of architectural and marketing knowledge must home builders and financiers be exposed to if they are to change their attitudes and behavior with respect to construction of energy conserving homes?" To deal with this issue two avenues were taken. First, the architecture and marketing staff members conducted a thorough literature search for information pertinent to the issue. Once this was done, they proceeded to conduct a survey of builders, financiers, and recent home buyers in an attempt to test the initial assumptions and ascertain the degree to which these populations reflected the substantive needs identified.

In this survey (See Appendix B) information was sought on (a) feelings about the energy shortage, (b) factors contributing to the energy shortage, (c) knowledge about ways of conserving energy in the construction of resi-

dential dwellings, (d) evaluation of several design concepts which are known to conserve energy in single-family dwellings, (f) current marketing programs being used, (g) present sources of information concerning planning design, and construction of single-family dwellings. Because of the complex nature of the subject--and the length of the questionnaire it was administered through a personal interview.

The marketing research firm of Higginbotham Associates, Inc. (Houston, Texas) was contracted to conduct the interviews in four cities within approximately two hundred miles of Houston. Computer programs to tabulate the results and statistical routines for analysis of the data were developed early in the second quarter of the project.

The findings of the survey were considered only suggestive because of the limited sample (non-probability), but a comparison of the responses provided valuable insight into the attitudinal aspects of the target population. The problem posed by the use of non-proability sample has been addressed to in appendix 'B'.

The following conclusions were drawn at the end of the end of the second quarter:

1. In general, the task of educating, sensitizing and getting builders to yield to the adoption of techniques which conserve energy in residential dwellings is a formidable one. When compared to consumers, fewer believe there is an energy shortage, and many do not see residential dwellings as a potential source of energy savings. Most builders in our sample tend to believe that consumers attached little or no importance to energy saving design features. Surprisingly, their knowledge about energy conservation appears to be no better than that

demonstrated by consumers. Further, builders tend to perceive consumers as less positive about the energy saving concepts than consumers actually are.

2. Thus, while the task of educating is formidable, it appears to be necessary. Whether we can get them to yeild to some or all of our messages on energy conservation is, at this time, problemtical. It seems that builders are, first and foremost, pragmatists. If we can convince them that (a) homes that conserve energy are saleable; i.e., a target market exists which is growing in size; (b) the costs associated with incorporating these concepts in their homes are nominal; (c) life-cycle costs are a better measure to use than initial costs because houses that conserve energy offer them a means of differentiating their product; and (d) our suggestions do not violate existing housing codes; we have a chance of changing their attitudes and altering their behavior in time.

Results of this survey--and one conducted by Houston Power and Light Company formed the basis for the program on "Marketing Energy Conserving Homes" in the learning package.

As information from the literature searches conducted and the preliminary data from the survey began to flow into the project, the education staff, working in conjunction with the architecture and marketing staff, began to isolate specific goals and objectives for the instructional program to be designed. These procedures took place mostly during the second and early part of the third quarter. The education staff, working closely with other project staff, clustered the goals and objectives into workable groupings around which instructional activities could be designed.

The instructional needs were categorized under four major areas:

1) Energy and People
2) Energy and Site
3) Energy and Building
4) Energy Conservation and Marketing

Energy and people: deals with people's need for energy to maintain adequate human comfort. This major area serves as the basic foundation of the entire learning program. Two critical subjects are covered within this area - (i) Human Comfort (ii) Role of Climate.

Human Comfort is a topic basic to the design of homes. Environmental conditions contributing to human comfort and their relationship to passive design features in dwellings and explored within this topic.

Climate is the second topic under the heading Energy and People. Regardless of the approaches people take in seeking adequate human comfort, various climatic conditions must be considered.

The second main area of concentration is the Energy and Building Site. Instructions within this area deal with the critical considerations involved in planning subdivisions. These considerations include the study of influences of site characteristics such as ground slopes, trees and ground cover on air temperature, relative humidity and air movement, and in turn on the consumption of energy by dwellings.

The third major area is Energy and Building. Instructions within this area include the effects of (1) various materials on energy consumption in dwellings (2) building shapes (3) orientations, size and construction of windows (4) shading of glass areas (5) natural ventilation and (6) daylighting.

The last major area Economic Evaluation and Marketing Energy Conserving Design Features is two-fold:

1) Describing a computer program for undertaking economic evaluation of energy conserving design features in homes.
2) Discusing some of the techniques for marketing energy conserving homes.

Along with the specification of goals and objectives, the education staff also began to establish criteria for selecting instructional strategies, specify alternative strategies for the instructional delivery system. With these tasks completed the entire staff then selected the instructional strategies deemed most appropriate for meeting project goals. This procedure was begun during the latter half of the second quarter of the project period, and continued into the third quarter of the project.

Design of Instructional Delivery System and Materials

The instructional delivery system called for a series of workshop sessions totalling approximately eighteen contact hours. This was primarily due to the amount of information that was to be imparted to the participants and the follow-up activities associated with the information sets.

The number of participants in each session varied from fifteen to thirty. Initially it was decided that participants would be divided into small groups iwth a maximum of fifteen, and a team of three facilitators representing architecture, education and marketing in order to maximize group interaction. However, once the instructional program was implemented it was found that a group as large as thirty to thirty-five can be handled

by one facilitator with the help of the Facilitator's Manual (described on page) and assisted by another person familiar with audio-visual equipment. The presence of staff from architecture and marketing sometimes did help in responding to follow-up questions or directing a discussion. Since the learning package was meant to be used eventually by a facilitator not necessarily with a background in architecture, the issue of questions and answers outside the manual has been addressed in the manual.

The activities during the workshop sessions focus on the use of passive systems in single-family dwellings as a means of conserving energy. The four major areas of concentration and their contents described earlier were organized on a three-day schedule. Following the first round of workshops it was realized that the workshop would function better with six evening sessions of three hours each. The reason for this modification will be discussed in greater detail in the next section of this paper.

During the workshop sessions several modes of instruction were employed depending on the complexity of a particular topic and the most suitable medium of instruction for such a topic. For example, instruction in Human Comfort, which is a rather abstract concept, 16mm animated sound film was used in explaining the concept. Following the film presentation participants were encouraged to discuss several issues related to human comfort, e.g., as a general rule what kinds of corrective measures would one have to take with regard to four environmental characteristics (temperature, relative humidity, air movement and radiation) to achieve a comfortable state in Ausust and February in the participant's city?

With regard to another topic, for example, Role of Climate, the mode of instruction is a slide-tape presentation followed by discussion and problem solving. Yet, in the case of another topic - Design Integration, which involved applying the theoretical knowledge from various sessions into the development of an energy conserving house design, used video tape to illustrate the design process. After exploring other mediums it was found that video tape recording was the most suitable medium to develop this rather complex topic in a very simple manner.

Another feature of the delivery system was the take-home materials which the participants were provided with for later reference. The take-home materials contained highlights of the audio-visual presentations regarding various topics covered in the workshop sessions. This avoided taking extensive notes by participants during the audio-visual presentations.

Facilitator's Manual

One of the necessary constituents of a program component is a set of guidelines as to how the component is to be used. In essence, this set of guidelines constitutes a small scale programmatic plan. Once all of the components are complete, these sets of guidelines are put together into a programmtic plan for implementing the total instructional delivery system. This plan appears in the learning package as a 'Facilitator's Manual". It describes in detail instructional process and the role a facilitator plays in its implementation.

The instructional process consists of meeting with the students in six three hour sessions. In each session one to three learning components are presented depending on its length. A total of eighteen hours instruc-

tion is required for the learning package. This manual provides an introduction to each workshop session and specified procedures for the activities, suggestions for discussion, and all materials needed. Scripts for the presentations are included in this manual.

One other project activity needs to be discussed herein - the procedures associated with the pilot testing of the project's instructional programs and procedures. Working in conjunction with the external evaluator for the project, an evaluation model and instrumentation was developed for use in assessing the instructional program components as described below:

Pilot Testing of the Instructional Material

While most of the materials for the instructional delivery system were completed during the first budget period, the pilot testing of the program components was completed during the second budget period. Following the pilot test, the instructional materials were revised.

The pilot test was conducted to obtain formative evaluation data regarding the materials and means of presentation involved in the instructional delivery system. A very select group (n=6) of highly regarded home builders and financiers in the Houston area constituted the pilot sample. The pilot sample consisted of three (3) home builders and three (3) representatives of financial institutions. Our original proposal called for fifteen (15) participants in the pilot study. However, the pilot sample was changed at the suggestion of the external evaluator, Dr. James K. Duncan. It was Dr. Duncan's belief and ours, that such a pilot group would use the material in a very critical way, thus providing the project staff with substantial formative information necessary for

making revisions before implementation with the target population.

The pilot participants were to view program components and, using the guide sheet as a stimulus for discussion, discuss among themselves their reactions to the component they were proceeding through. In addition to providing their own perceptions of the program components, they were to discuss how they felt their colleagues in the building industry would react to the program component.

After the pilot participants proceeded through a program component, they were then to provide their individual reaction to the component using a Component Questionnaire included in their packet of materials (See Appendix D). This reaction they were to provide without further discussion with other pilot participants.

At the conclusion of the final pilot testing session, the participants were asked to provide their general reaction to the total program.* This reaction was obtained during a group discussion focused on a critique of the total program. This discussion was audio taped with the tapes being analyzed for significant information relative to changes that were needed in the instructional materials and processes.

The results of the pilot testing yielded two kinds of data. Qualitative statements regarding the material and some desirable modifications in the program components constituted one kind of data. A second was the scores obtained in the Likert items. The results and the pilot test as a whole have been discussed in detail in appendix 'D'.

*This also represents a departure from the proposal for the pilot testing. We felt that the discussions following each session were free, open, and informative. With this being true, we decided to attempt this process to obtain the overall feedback. We found this to be quite successful and decided to eliminate the written report.

Implementing the Instructional Delivery System

Invitation to participate in the workshops were sent to builders and representatives of financial institutions within the study area (Houston, San Antonio and Austin). We had originally anticipated a total of 120 participants. However, we received 45 requests from Houston, 20 from Austin and 20 from San Antonio. When the three day workshop began our attendance was as follows: Houston 19, Austin 12, and San Antonio 13. Several would-be participants indicated that it was very difficult to give up three days at the office for the sessions. Based on these feedback we arranged a second round of workshop consisting of six three hours sessions in the evenings, spread over three weeks. We have discussed this modified schedule later in this paper.

During the planning stage we felt that we would need two facilitation teams to present the workshops. However, the smaller enrollment resulted in our using one three-person team. The team consisted of a representative from Education, Architecture and Marketing.

As the program was being implemented with the target population, we identified a number of minor changes that needed to be made either in the program or in its mode of presentation. These changes resulted in a much smoother operation of the session. The changes primarily concerned the reallocation of time to various components, expanding the directions for some activities and making additions to some of the program materials to facilitate a better understanding.

A second round of workshops was necessitated due to the rather low response to the first round. Due to a modified schedule, as shown on page 18, the response to the second round was considerably better. There were

A THREE-DAY WORKSHOP SCHEDULE

Day 1

I Opening Remarks

Why Build Energy Conserving Homes?

Pretest

Break

II Introduction of Participants

What Will the Workshop Do For You?

"Program Overview" and participate in follow-up discussion

Introduction of Computer Based Economic Evaluation

III "Human Comfort"

This presentation explains the influences of temperature, relative humidity, air movement and sun on human comfort and their design implications

Participate in follow-up activity

Lunch Break

IV "Role of Climate"

This presentation explains the influence of climate on the design of homes and the importance of climatic information at the building site

Participate in follow-up activity

Break

V "Energy and Site"

This presentation explains the role a building site plays in energy conservation

The follow-up activity consists of Participants laying out, in groups a subdivision incorporating energy saving techniques.

Day 2

I Review of Sessions I and II

"Building Envelope and Thermal Phenomena"

This session is designed to develop an understanding of how the building surface behaves with respect to heat

Follow-up activity, discussion and problem solving

Break

II "Sun and Building Shape"

This presentation points out the most desirable shapes which can be energy conserving in a hot and humid climate

Follow-up activity

III "Fenestration" (windows and doors)

This session will deal with loss or gain of heat in homes through doors and windows. Some preventive techniques and their economics

Follow-up activity

Lunch Break

IV "Natural Ventilation"

This session on natural ventilation will deal with air-flow characteristics in and around buildings and how to ventilate homes naturally

Follow-up activities, locating windows for natural ventilation in a given design of homes

V "Daylighting"

This presentation explains the importance of using daylight in conserving energy in homes and how to design for daylighting

Break

VI "Building Materials Construction"

This session discusses a set of guidelines for selecting materials for roof, walls and floor and the cost effectiveness of material selection

Follow-up activities -- problem solving

Day 3

I Design an energy conserving home

Break

II Follow-up activity -- view video-tape presentation titled, "Design Integration"

This session will show how the various pieces of information from all the previous sessions fit together in the design of a home

Lunch Break

III "Marketing Techniques for Energy Conserving Homes"

Follow-up activity - Prototypical Sales Material

Break

IV Post test

Evaluation

Closing

A SIX-SESSION WORKSHOP SCHEDULE

SESSION I 7:00 p.m.

(i) Opening Remarks

(ii) Why Build Energy Conserving Homes?

(iii) Pretest

(iv) Introduction of Participants

(v) What Will the Workshop Do For You?

(vi) "Program Overview" and participate in follow-up discussion

(vii) Introduction of Computer Based Economic Evaluation

(viii) "Human Comfort"

This presentation explains the influences of temperature, relative humidity, air movement and sun on human comfort and their design implications

(ix) Participate in follow-up activity

SESSION II 7:00 p.m.

(i) "Role of Climate"

This presentation explains the influence of climate on the design of homes and the importance of climatic information at the building site

(ii) Participate in follow-up activity

(iii) "Energy and Site"

This presentation explains the role a building site plays in energy conservation

(iv) The follow-up activity consists of participants laying out, in groups a subdivision incorporating energy saving techniques

SESSION III 7:00 p.m.

(i) Review of Sessions I and II

(ii) "Building Envelope and Thermal Phenomena"

This session is designed to develop an understanding of how the building surface behaves with respect to heat

(iii) Follow-up activity, discussion and problem solving

(iv) "Sun and Building Shape"

This presentation points out the most desirable shapes which can be energy conserving in a hot and humid climate

(v) Follow-up activity

(vi) "Fenestration" (windows and doors)

This session will deal with loss or gain of heat in homes through doors and windows. Some preventive techniques and their economics

(vii) Follow-up activities

SESSION IV 7:00 p.m.

(i) "Natural Ventilation"

This session on natural ventilation will deal with air-flow characteristics in and around buildings and how to ventilate homes naturally

(ii) Follow-up activities, locating windows for natural ventilation in a given design of homes

(iii) "Daylighting"

This presentation explains the importance of using daylight in conserving energy in homes and how to design for daylighting

(iv) "Building Materials and Construction"

This session discusses a set of guidelines for selecting materials for roof, walls and floor and the cost effectiveness of material selection

(v) Follow-up activities -- problem solving

SESSION V 7:00 p.m.

(i) Design an energy conserving home

(ii) Follow-up activity -- view videotape presentation titled, "Design Integration"
This session will show how the various pieces of information from all the previous sessions fit together in the design of a home

SESSION VI 7:00 p.m.

(i) "Marketing Techniques for Energy Conserving Homes"

(ii) Follow-up activity - Prototypical Sales Material

(iii) Post test

40 requests from Houston, 39 from Austin and 20 from San Antonio. Twenty-eight of the Houston participants, 21 Austin participants and 9 San Antonio participants completed the workshops.

Follow-up Service

The follow-up service consisted of providing the participants with economic evaluation of energy conserving design features which anyone might be thinking of incorporating in the homes following the workshops. This evaluation tool consisted of a computer program which was developed by the project staff. The builders provided the project office, in response to a questionnaire, a detailed list of the various design components of the dwelling indicating dimensions, material selections, orientations, efficiency of heating and cooling equipment and estimated selling price. The project staff converted this questionnaire into a computer format and the information was then run through the computer program.

The computer printout (pages 20, 21) which is returned to the participants, gives the estimated selling price of the home with a given set of energy conserving design features and month by month heating and cooling costs. The printout also provides total yearly heating and cooling costs for the original design and for a design with a set of modifications. Only three sets of modifications, along with the original design are analyzed and ranked in order of life cycle costs per year per design. Life cycle cost is the total amount which will be paid out by the consumer for the mortgage operation and maintenance of the home. By examining this ranking of life cycle costs one can tell which design option is the most cost-effective.

The life cycle costs is an important decision factor for the builder,

SUMMARY

THE ORIGINAL DESIGN AND CHANGES WHICH YOU HAVE PROVIDED ARE LISTED AND ORDERED BELOW ACCORDING TO ENERGY RELATED LIFE - CYCLE COSTS PER YEAR. LIFE - CYCLE COST PER YEAR REPRESENTS A CONCEPT VALUE WHICH INCLUDES THE PRINCIPAL AND INTEREST FOR THE INITIAL MORTGAGE OF THE HOME, YEARLY MAINTENANCE OF ENERGY RELATED MATERIALS, AND THE YEARLY OPERATING COST TO HEAT AND COOL THE HOME. LIFE - CYCLE COSTING PROVIDES A GOOD MEASURE FOR THE EVALUATION OF ENERGY DESIGN DECISIONS IN THAT IT REPRESENTS AN APPROXIMATE FIGURE EQUAL TO WHAT THE CONSUMER WILL SPEND PER YEAR FOR A PARTICULAR HOME. IF AN ENERGY RELATED DESIGN CHANGE CAUSES AN INCREASE IN THE INITIAL COST OF THE HOME, THE INCREASED YEARLY PRINCIPAL AND INTEREST MUST BE OFF SET BY REDUCED YEARLY OPERATING AND MAINTENANCE COSTS. IF THIS IS ACHIEVED, THE CONSUMER WILL SAVE MONEY THROUGH THE DESIGN CHANGE.

COMPARTITVE ANALYSIS

CASE	LIFE CYCLE COST
3	$ 8097.18
0	$ 9111.50
2	$ 8175.88
1	$ 8175.15

FOLLOWING IS AN ITEMIZED ECONOMIC DATA SHEET FOR THE ORIGINAL AND EACH OF THE CHANGES YOU HAVE SUBMITTED.

NOTE: THE COSTS INDICATED ON THIS PRINT-OUT MAY NOT REFLECT THE ACTUAL COSTS WHICH THE CONSUMER IS LIKELY TO INCUR, BECAUSE THIS ANALYSIS DOES NOT RECOGNIZE THE IMPERFECTIONS IN ACTUAL ON-SITE CONSTRUCTIONS ANY MORE THAN WHAT IS NORMALLY ASSUMED IN HEATING AND COOLING LOAD CALCULATIONS.

OPTION CASE 0

THE ESTIMATED SELLING PRICE OF THIS HOME IS $ 77500.00 .

MONTH	HEATING COST ($)	COOLING COST ($)	TOTAL COST ($)
JANUARY	93.01	1.55	82.56
FEBRUARY	28.99	2.09	31.09
MARCH	18.67	5.53	24.20
APRIL	2.27	14.75	17.02
MAY	.00	21.90	21.90
JUNE	.00	85.99	85.99
JULY	.00	53.99	53.99
AUGUST	.00	59.28	59.28
SEPTEMBER	.00	40.97	40.97
OCTOBER	2.32	19.71	22.03
NOVEMBER	15.20	3.62	18.90
DECEMBER	32.93	1.05	33.89
YEARLY TOTAL	141.38	275.10	416.48

IF THE CONSUMER TAKES ADVANTAGE OF THE VENTILATION WHICH THIS PLAN PROVIDES THE YEARLY OPERATING COST WILL BE REDUCED TO $ 400.30 . AMOUNTING TO A SAVINGS OF $ 16.18 PER YEAR.

LIFE CYCLE COST PER YEAR OF THIS DESIGN EQUALS $ 9111.50 .

OPTION CASE 1

THE ESTIMATED SELLING PRICE OF THIS HOME IS $ 78487.00 .

MONTH	HEATING COST ($)	COOLING COST ($)	TOTAL COST ($)
JANUARY	36.32	1.49	37.76
FEBRUARY	25.67	1.99	27.67
MARCH	16.98	5.33	21.87
APRIL	2.01	14.00	16.00
MAY	.00	30.25	30.25
JUNE	.00	42.62	42.62
JULY	.00	51.20	51.20
AUGUST	.00	73.87	73.87
SEPTEMBER	.00	19.47	19.47
OCTOBER	2.10	18.69	20.79
NOVEMBER	11.57	4.43	16.00
DECEMBER	29.07	.99	30.06
YEARLY TOTAL	123.19	273.83	396.08

IF THE CONSUMER TAKES ADVANTAGE OF THE VENTILATION UNTCH THIS PLAN PROVIDES THE YEARLY OPERATING COST WILL BE REDUCED TO $ 370.74 . AMOUNTING TO A SAVINGS OF $ 15.74 PER YEAR.

LIFE CYCLE COST PER YEAR OF THIS DESIGN EQUALS $ 8175.1[illegible] .

OPTION CASE 2

THE ESTIMATED SELLING PRICE OF THIS HOME IS $ 78721.84 .

MONTH	HEATING COST ($)	COOLING COST ($)	TOTAL COST ($)
JANUARY	32.81	1.28	34.09
FEBRUARY	23.19	1.76	24.95
MARCH	14.91	4.72	19.62
APRIL	1.81	17.39	19.20
MAY	.00	26.76	26.76
JUNE	.00	38.61	38.61
JULY	.00	41.22	41.22
AUGUST	.00	45.55	45.55
SEPTEMBER	.00	24.05	24.05
OCTOBER	1.99	16.95	18.94
NOVEMBER	17.22	3.68	20.90
DECEMBER	26.25	.93	27.19
YEARLY TOTAL	118.09	330.92	344.02

IF THE CONSUMER TAKES ADVANTAGE OF THE VENTILATION UNTCH THIS PLAN PROVIDES THE YEARLY OPERATING COST WILL BE REDUCED TO $ 330.44 . AMOUNTING TO A SAVINGS OF $ 13.78 PER YEAR.

LIFE CYCLE COST PER YEAR OF THIS DESIGN EQUALS $ 8155.44 .

OPTION CASE 3

THE ESTIMATED SELLING PRICE OF THIS HOME IS $ 77283.78 .

MONTH	HEATING COST ($)	COOLING COST ($)	TOTAL COST ($)
JANUARY	41.01	1.57	42.58
FEBRUARY	28.99	2.15	31.08
MARCH	18.61	5.99	24.[illegible]
APRIL	2.27	14.70	17.07
MAY	.00	21.90	21.90
JUNE	.00	35.99	35.99
JULY	.00	39.33	39.33
AUGUST	.00	54.28	54.28
SEPTEMBER	.00	30.57	30.57
OCTOBER	2.37	19.71	22.08
NOVEMBER	13.28	7.72	13.90
DECEMBER	32.83	1.05	33.89
YEARLY TOTAL	141.38	275.10	416.48

IF THE CONSUMER TAKES ADVANTAGE OF THE VENTILATION UNTCH THIS PLAN PROVIDES THE YEARLY OPERATING COST WILL BE REDUCED TO $ 400.30 . AMOUNTING TO A SAVINGS OF $ 16.18 PER YEAR.

LIFE CYCLE COST PER YEAR OF THIS DESIGN EQUALS $ 8087.18 .

the consumer and the financier in building, buying and financing energy conserving homes. A builder cannot build unless he or she is reasonably sure that the homes will sell. The consumer cannot buy unless the added yearly expenses for an energy conserving home is off-set by the savings in energy bills. The financier is interested in recovering the added expense within a reasonable period of time. It was necessary for us, therefore, to indicate to the participants how much and what modifications can be made to existing systems of buildings to be cost-effective and increase saleability.

Modeling the Evaluation Process

From the beginning of the project, the process of formative evaluation was conducted by project personnel (internal evaluation) working closely with the sub-contracted external evaluator (James K. Duncan of The Ohio State University). The development and modification of a model and collection of relevent project data utiiizing the model was the major responsibility of the internal evaluation staff.

The specific model selected closely followed the Ambry model discussed in "Evaluation for Environmental Education" in Taylor, P. A. anc Cowley, D. M. Readings in Curriculum Evaluation. (Dubuque, Wm. C. Brown and Company, 1972). Phases of the program evaluation identified were:

(A) Planning- - - - concerned primarily with conceptualization and design of total project.

(B) Operations - - measures taken to provide environment for implementation of proposed program.

(C) Development - - actual production of artifacts.

(D) Implementation- components put into actual operation.

To asses the functioning of these phases, four process components were

applied to them. These components were (1) standards; (2) performance; (3) comparison of (1) and (2); and resulting discrepancy information (4) which led to termination, review and rework, or proceeding to next phase. A detailed discussion of the model and its application are given in appendix 'F'.

The value of continuous formative evaluation was demonstrated in the third quarter when the relatively rapid movement into a very productive state in the project could be attributed to the settling of a communication "problem". Interaction of the staff in sessions where the staff from the architecture component directly "taught" the education staff and discussed the concepts which had to be brought out in the training sessions facilitated clearer objectives and better curriculum pieces.

An examination of the information obtained by implementing the formative evaluation model through the project reveals some interesting insight into an interdisciplinary development effort such as these--

1) If an interdisciplinary curriculum development project is to function effectively it must have a well established communication channel

2) If an interdisciplinary curriculum development project is to be effective, it must have a clear organizational structure

3) Wise utilization of staff is essential in interdisciplinary curriculum development project

4) Institutional support for project staff is essential

Dissemination

As the project has unfolded, there has been some recognition of it in the local media. Project principals have been invited to make presentations regarding the various aspects of the projcet at local and national meetings, conferences and symposia.

Enquiries regarding the project were received from the various parts of the country. Whenever possible relevant information were provided to the enquirers.

The formal dissemination really began with the pilot study. Although the pilot study was intended for collection of immediately useful information, it generated some interest in the project on the part of home builders and financiers. The pilot study was the first instance in which the content, materials, activities and intents of the experimental learning package were interfaced with the target population and its knowledge, skills and attitudes.

Following the pilot study and modification of instructional materials and system, the formal dissemination was continued through the organization of training workshops from January 1977 through June 1977 in Houston, San Antonio and Austin. These workshops have been described in detail on page 16 and in appendix 'E'.

The dissemination efforts culminated in organizing a national symposium on Energy Conservation Education. The symposium, held in Washington, D. C. in October, 1977, was an attempt to bring people from diverse backgrounds together to address issues related to energy conservation education.

There were four major objectives for the symposium:

1. To examine the need for, and nature of educational programs in energy conservation;
2. To examine the issues and processes involved in the design, development, implementation and evaluation of educational programs in energy conservation;
3. To explore the role of government in providing for programs in energy conservation;
4. To examine the present cooperative efforts in education for meeting the energy problem.

To address these critical objectives several people, noted for their work on energy related issues, were asked to present papers dealing with various aspects of the energy conservation education problem.

Among the people who presented papers at the symposium were educators, architects, representatives from the Department of Energy, savings and loan personnel, and a representative from the National Home Builders Association (See program schedule on page 26).

The format for the symposium called for the presentation of related papers followed by a panel discussion of additional issues alluded to in the papers.

During the first day of the symposium educators presented papers dealing with the need for design and evaluation of educational programs in energy conservation. In the afternoon representatives from the National Home Builders Association and the Department of Energy presented papers dealing with the kinds of educational programs that were currently available as well as the nature of programs needed. The second day of the conference concerned the presentation of papers dealing with specific education programs in energy conservation that were currently operating.

The papers presented at the symposium have been edited separately.

These papers offer no panacea to the energy problems, but they do explore some possible alternatives for dealing with a very critical energy crisis.

NATIONAL SYMPOSIUM ON ENERGY CONSERVATION EUDCATION, WASHINGTON, D. C.
October 24 - 26, 1977

PROGRAM SCHEDULE

Monday, October 24, 5:00 - 8:30 p.m.

Registration and Inaugration of Symposium 5:00 - 8:30 p.m.

Welcome address: Dr. Eugene Walden, U. S. Office of Education

Keynote Speaker: Dennis Hayes, WORLDWATCH INSTITUTE

Tuesday, October 25 - Morning Session 9 a.m. - 12 noon

Dr. Harold Shane, University Professor of Education, Indiana University. Topic: The Need For and Nature of Energy Conservation Education.

Dr. Truman D. Whitfield, Assistant Professor of Education, Murray State University. Topic: Design of Energy Conservation Education Program.

COFFEE BREAK 10:15 - 10:40 a.m.

Dr. George Dawson, Head Science Education, Florida State University. Topic: An Interdisciplinary Model for Energy Conservation Education.

Dr. James K. Duncan, Professor of Curriculum, Ohio University. Topic: Energy Conservation Education: A Perspective for Evaluators.

LUNCHEON 12:00 noon

Afternoon Session 1:30 - 5:00 p.m.

Donald Duggan, Chief, Education Program Branch, Department of Energy, Washington, D. C. Topic: The Role of Government in Energy Education.

Rene Vawter, Department of Energy, Washington, D. C. Topic: Educational Aspects of Energy Conservation Programs in Federal Government.

COFFEE BREAK 2:45 p.m.

PANEL DISCUSSION 3:00 p.m.

Panelists:

Dr. Wilfred Burton, Manager, Educational Services, American Gas Association, Arlington, Virginia

Dr. George Dawson, Science Education, Florida State University

Mr. Donald Duggan, Chief, Education Program Branch, Department of Energy

Dr. Harold Shane, Professor of Education, Indiana University

Moderator: Dr. Truman D. Whitfield, Murray State University

Wednesday, October 26 - Morning Session 9 a.m. - 12 noon

Andrew Sansom, Deputy Director, Energy Institute, University of Houston. Topic: Some Observations on the Energy Conservation Education.

Dr. David MacKenna, Institute of Urban Studies, University of Texas at Arlington. Topic: Local Government and Energy Conservation Education.

COFFEE BREAK 10:10 - 10:25 a.m.

Dr. Hans Isakson, Department of Real Estate and Urban Development, University of Georgia. Topic: The Development of an Energy Related Curriculum for Real Estate Professionals.

Jeffery Cook, Professor of Architecture, Arizona State University. Topic: Education of Architects for Energy Conservation.

Phillip Gasteyer, Associate Director, U. S. League of Savings Association, Washington, D. C. Topic: Attitudes Toward Home Improvement Financing for Energy Conservation.

LUNCHEON 12:10 p.m.

Afternoon Session 1:30 - 5:00 p.m.

Thomas Caldwell, Director of Training, National Association of Home Builders, Washington, D. C. Topic: A Report on the National Association of Home Builders Energy Conservation Educational Programs.

Ranjit K. Banerji, Associate Professor (Visiting) College of Architecture, University of Houston. Topic: A Learning Package in Energy Conservation for Participants in the Home Building Industry.

COFFEE BREAK 2:45 p.m.

PANEL DISCUSSION

Panelists:

Mr. Thomas Caldwell, Director of Training, National Association of Home Builders.

Professor Jeffery Cook, Arizona State University

Mr. Phillip Gasteyer, U. S. League of Savings Association

Dr. Hans Isakson, University of Georgia

Moderator: Mr. Andrew Sansom, University of Houston

SUMMATIVE EVALUATION

The Study Design

A before-after/test-control group study design was employed for this research project.

A total of four measurement periods are analyzed in this report--before, after, three to four months after, and eight to nine months after. In the case of the control group, all four surveys were conducted by mail with a random sample of builders in New Orleans. In the case of the test group, the first questionnaire was administered at the first session of the seminar, the second questionnaire at the end of the last seminar session, and the third and fourth questionnaires were sent to respondents in the mail. All questionnaires for each measurement period and for both test and control groups were self administered.

All persons attending the training seminar were included in the test group sample. A total of 22 respondents completed all four measurement period questionnaires.

The control group represents a random sample of all builders in the New Orleans area. The sample was drawn from the membership roster, Home Builders Association of Greater New Orleans, Inc., 1976-1977. A total of 20 respondents completed all four measurement period questionnaires.

Testing of Hypotheses

The object of this research is to find out what effects the experimental learning package has had on the knowledge, attitude, and behavior of participants with respect to energy conservation in home building. Prior evidence suggests that gains are to be expected in terms of increased knowledge, more favorable attitudes, and greater likelihood of practicing energy conservation measures in home building.

In order to test hypotheses, a total score for each respondent was developed for each of these three components--Knowledge, Attitude, and Behavior. Since a large number of questions were included on the questionnaire, they were grouped into the three components just identified. Since this method of analysis had not been anticipated, different scales were used for various questions. In order to overcome this problem, the data was recorded to produce a seven-point scale or a "7" for correct and a "0" for incorrect. Then all the questions related to attitude were summed to produce a total attitude score for each respondent for each of the four measurement periods. This same procedure was followed for the knowledge component questions and for the behavior component questions.

Table 3-1 shows the trend in the average scores for each component (knowledge, attitude, behavior) from measurement period one through four for both the control and test groups.

Table 3-1

A Tabulation Of The Combined Value Of Scales Used To Evaluate The Knowledge, Attitudes, And Behavior Of The Test And Control Groups

Average Score Values

	Test Group Surveys				Control Group Surveys			
Total Observations	1/22	2/22	3/22	4/22	1/20	2/20	3/20	4/20
Knowledge Score	84.64	90.36	85.91	94.18	77.00	81.55	77.00	82.25
Attitude Score	137.55	148.64	149.45	147.18	122.00	127.15	131.95	134.65
Behavior Score	58.73	61.73	67.45	62.45	57.20	61.55	62.95	63.40

Note:----High Value Of Scales Indicate A Favorable Or Positive Attitude Or Behavior. And High Values Indicate Correct Knowledge.

The hypotheses tested in this report are stated below:

1. There will be no gain in knowledge of energy conservation practices in home building exhibited by participants as a result of participation in the Home Energy Conservation workshops.

2. There will be no gain in attitude favorable toward energy conservation in home building exhibited by participants as a result of participation in the Home Energy Conservation workshops.

3. There will be no gain in deposition to behavior favorable toward energy conservation in home building exhibited by participants as a result of participation in the Home Energy Conservation workshops.

Table 3-2 on the following page presents a 1 x 1 Analysis of Variance Test of the three hypotheses. This analysis indicates that at the 95% confidence level there was a favorable change in the attitude and knowledge components between measurement periods one and four, and that there was not a significant change among respondents in the control group during this same period.

Table 3-2

1 x 1 Analysis of Variance

Hyptothesis	Group/Measurement Period/(Mean Score) 1/	F Ratio
1. Knowledge	T1 (84.6) vs. T4 (94.2)	2.37 *
2. Attitude	T1 (137.5) vs. T4 (147.2)	2.99 *
3. Behavior	T1 (58.7) vs. T4 (62.4)	0.71
1. Knowledge	C1 (77.0) vs. C4 (82.3)	1.04
2. Attitude	C1 (122.0) vs. C4 (134.7)	1.19
3. Behavior	C1 (57.2) vs. C4 (63.4)	1.12
1. Knowledge	T1 (84.6) vs. C1 (77.0)	1.31
2. Attitude	T1 (137.5) vs. C1 (122.0)	0.82
3. Behavior	T1 (58.7) vs. C1 (57.2)	1.15
1. Knowledge	T4 (94.2) vs. C4 (82.2)	0.58
2. Attitude	T4 (147.2) vs. C4 (134.7)	0.33
3. Behavior	T4 (62.4) vs. C4 (63.4)	1.80

* Significant at 0.05 level

1/ Definitions are as follows:

T = Test group
C = Control group
1 = First Survey
2 = Second Survey
3 = Third Survey
4 = Fourth Survey

A 2 x 2 Analysis of Variance is presented in Table 3-3 on the following page. There is a highly significant difference for each of the attitude models tested. And there is a significant difference for the knowledge model that evaluated the difference between the first and fourth measurement periods.

In summary, it appears that the experimental learning package was probably effective in increasing knowledge and definitely effective in improving attitudes related to the conservation of energy in home building. It was not (or has not been as yet) effective in changing behavior; but in the short run and in light of the many variables this is to be expected.

Table 3-3

2 x 2 Analysis of Variance

Hypothesis	Model 1/	F Valve	Probability of F Valve
1. Knowledge	T1 T2 C1 C2	2.52	.0624
2. Attitude	T1 T2 C1 C2	12.81 *	.0000
3. Behavior	T1 T2 C1 C2	.18	.9093
1. Knowledge	T1 T3 C1 C3	1.61	.1918
2. Attitude	T1 T3 C1 C3	11.02 *	.0000
3. Behavior	T1 T3 C1 C3	.75	.5261
1. Knowledge	T1 T4 C1 C4	4.43 *	.0064
2. Attitude	T1 T4 C1 C4	9.28 *	.0000
3. Behavior	T1 T4 C1 C4	.27	.8441

* Significant at 0.05 level

1/ Definitions are as follows

T = Test group
C = Control group
1 = First Survey
2 = Second Survey
3 = Third Survey
4 = Fourth Survey

External Evaluation

The external evaluation of the project was undertaken by Dr. James K. Duncan, Professor, Curriculum and Foundation Department, The Ohio State University, Columbus, Ohio.

The Contracts included, besides on site consultations, the following:

1) Continue to provide guidance in the development and modification of the evaluation model and data collection instruments and procedures.

2) Provide external monitor over data collection to insure consistency with the evaluation model and with the goals specified at the onset of the project.

3) Review data generated by the evaluation model each month and provide preliminary formative evaluation reports.

4) Provide written feedback on each of the above for the project staff to be used in a formative sense.

5) Provide quarterly reports as requested by project staff.

6) Provide final project evaluation report.

The interim reports from the external evaluator were appended to the quarterly project performance reports for submission to the granting agency in compliance with the terms and conditions of the grant. The final external evaluation report appears in appendix 'H' accompanying this final project report.

Dr. Duncan's input throughout the project has been extremely useful in fulfilling the project objectives.